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Thermal Barrier Coating Workshop, 1997

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Foreword

Thermal Barrier Coatings (TBC's) in current gas turbine engines routinely deliver metal temperature reductions of 50-80°C under normal conditions and as much as 140 °C temperature reductions in hot spots. With potential benefits estimated to be greater than 170 °C, TBC's offer a huge potential boost to the operating temperature capability of turbine components, roughly equivalent to 40 years of superalloy improvements. The high potential for increasing operating temperatures, and for deriving the associated efficiency increases, has fueled an explosion of TBC research.

While the potential of TBC's is great, TBC development has necessarily followed the path of other new materials. Following a period of R&D, TBC's are now serving in the conservative function of increasing metallic component life at current engine temperature levels. As the level of experience, and comfort, with the use of TBC's in these conservative applications has increased, the willingness to consider more aggressive use of TBC's in engines has also increased. TBC's are now viewed as one of the most viable means to achieve significant increases in engine efficiency.

While current TBC applications have been developed in spite of large gaps in knowledge of TBC behavior, the step up to higher risk applications requires a higher level of understanding. Specifically, designers must have the confidence that the coatings will behave predictably before the coatings will be used in critical applications. Unfortunately, gaps in knowledge span the range from a lack of detailed understanding of processing and how processing affects coating structure and properties, to a sketchy understanding of the processes leading to failure of a coating. Interestingly, even the basics of heat transfer through a coating are at a rudimentary stage of understanding.

Filling in these gaps is a substantial challenge but a challenge that must be met to take the next step in TBC technology. There are notable efforts in virtually all areas of TBC research that are working to fill these gaps. The papers contained in this volume provide some insights on current work addressing the two most critical properties of TBC's, heat transfer to and through the coating and coating durability. These papers were presented at the 1997 TBC Workshop, held in Cincinnati, Ohio, May 19-21, 1997. The workshop was sponsored by the TBC Interagency Coordination Committee. Committee members include Air Force Office of Scientific Research, Air Force Materials Directorate, The Department of Energy, DARPA, National Aeronautics and Space Administration, National Institute of Standards and Technology, Navy and Office of Naval Research. Significant organizational assistance and the funding to make this workshop a reality were provided by Capt. C.M. Ward and Dr. A. Pechenek of the Air Force Office of Scientific Research. I am also grateful to Drs. S.J. Dapkunas of NIST and W.Y. Lee of Oak Ridge National Laboratory for organizational assistance. Special thanks are due to Ms. Renee Madden of DTC, Inc., who did an excellent job in making all the arrangements of this workshop and compiling the papers contained in this volume.

William J. Brindley
Chair TBC Workshop

